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FACT SHEET

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High Lysine Corn for Swine

Since 1964 when high lysine corn was discovered by Purdue scientists, its potential and application in the swine industry have been widely discussed. Producers are aware that feed costs are 60-75 percent of the total cost of producing swine. If supplemental protein can be reduced or eliminated in swine diets without adversely affecting performance, the feed bill can be reduced. The development and use of high lysine corn in swine diets provide a way to reduce the need for supplemental protein. It is important to note that the value of high lysine corn increases when protein supplement prices increase. This fact has led to even greater interest in the use of high lysine corn for swine.

General Characteristics of High Lysine Corn

It has been known for many years that cereal grains (corn, barley, milo and oats) do not contain adequate amounts of lysine, tryptophan, isoleucine and threonine (essential amino acids—building blocks of protein) to support maximum gain in growing swine. Lysine is the most limiting amino acid in corn and other cereal grains.

High lysine corn, also called Opaque-2 corn, is a new type of corn that usually provides more lysine and tryptophan than found in "normal corn." Although quite variable, lysine content sometimes is doubled, and tryptophan content may be increased by about 50 percent in high lysine corn compared with normal corn (table 1).

Table 1. Essential Amino Acid Composition of Normal and High Lysine Corn (percentages)*

	Normal corn	High lysine corn
Amino acids		
Lysine	.26	.43
Tryptophan	.07	.10
Methionine + cystine	.30	.32
Histidine	.25	.32
Arginine	.37	.57
Threonine	.32	.36
Valine	.45	.53
Isoleucine	.34	.33
Leucine	1.11	.85
Phenylalanine	.43	.41

*Analysis of some corn samples (near equal protein content) used in Minnesota studies.

Protein content also is variable and may range from nearly equal (possibly even less) to 1-3 percentage units greater in some high lysine corn.

High lysine corn has a light pale or bleached color, appears somewhat shriveled, and has a softer kernel that is easier to grind.

PRODUCTION PROBLEMS: A few production problems apparently occur with high lysine corn. Many of these problems may be reduced or eliminated as corn breeding research develops better high lysine hybrids during the next few years. For example, grain yields for high lysine corn are about 8 to 10 percent less than normal corn. This yield reduction occurs primarily as a result of the reduced test weight per bushel. Even with a reduced yield, high lysine corn may be profitable in swine feeding depending upon its lysine content and the value of the amount of protein supplement replaced.

Also, high lysine grain may be 2 to 4 percent higher in moisture content at harvest, and it apparently dries slower under field conditions. Planting the high lysine corn first in the spring can allow it the extra 5-7 days needed to dry in the fall. Molds may develop more readily on ears of high lysine corn in the field and in storage until dried to about 14 percent moisture. A number of Minnesota growers surveyed indicated satisfaction with their high lysine corn and intended to plant more another year. In some cases, however, they did note higher moisture content at harvest and more evidence of mold with high lysine corn compared with conventional hybrids.

Another production problem is contamination from crossing of high lysine corn with pollen from fields of normal corn. Some degree of isolation from fields of normal corn is necessary to prevent this. The importance of isolation will depend upon the desired purity level.

High Lysine Corn Should be Analyzed for Lysine Content

The original Opaque-2 corn studied at Purdue contained about 0.5 percent lysine. Producers shouldn't think that all high lysine corn will contain this level, or even, as much as 0.4 percent lysine. Analyses made at the University of Minnesota and other laboratories show that lysine levels may not consistently be as great as 0.4 percent. Varying degrees of cross-pollination may be a major factor for this inconsistency in lysine content. Normal corn varies (from about 0.2-0.3 percent) in lysine content while high lysine corn has been reported to contain from 0.35 to 0.55 percent lysine. Therefore, lysine content varies considerably in high lysine corn, and the actual lysine content must be known to predict its value as a swine feed. A much greater saving in protein supplement is possible when pigs are fed 0.5 percent lysine corn than when the corn contains only 0.3 percent.

OBTAINING A REPRESENTATIVE CORN SAMPLE FOR LYSINE ANALYSIS: With a probe or below-surface handful, producers should sample at several locations from the bin or storage area. They should combine and thoroughly mix these subsamples and from this take about a half pound sample for analysis.

Some producers might consider that analysis costs are too high, but the possible saving easily can offset the costs of determining lysine (and protein)—perhaps $20-$25 per sample. If the amount of protein supplement in the diet fed growing pigs (40 to 210 pounds) is reduced 5 percentage units, this amounts to 25 to 30 pounds per pig marketed. If 100 pigs are produced, the potential saving in protein supplement can be as great as 2,500 pounds. If soybean meal, 44 percent protein, costs $150 a ton, the value of soybean meal eliminated from the diet is $187.50, more than enough to offset the cost of lysine and protein determinations.

Feeding Value of High Lysine Corn

The value of high lysine corn for swine lies in its capacity to support optimal rate of gain and feed/gain with less supplemental protein than required with normal varieties of corn. Reports of several experiments from the University of Minnesota and other experiment stations indicate that high lysine corn can be used effectively in all phases of a swine feeding program.

Since the growing-finishing phase of production represents the period of greatest feed consumption, this period offers the greatest potential for use of high lysine corn. If the lysine content runs as high as 0.5 percent, little if any supplemental protein is needed for pigs that weight more than 125 pounds. Feeding high lysine corn containing 0.4 percent lysine or more would mean lowering the need for protein supplement by about one-third. CAUTION: Swine diets based on high lysine corn and a complete protein-mineral-vitamin supplement require some increase in mineral and vitamin content of the protein supplement to assure adequate level of these nutrients when the supplement is used at lower levels.

Research has shown that no supplemental protein was required when feeding high lysine corn to pregnant sows and gilts. There was essentially no difference in reproductive performance (farrowing percentage, litter size, and birth weight) when sows were fed either a high lysine corn diet (fortified with minerals and vitamins, no supplemental protein) or a fortified 12 to 16 percent protein normal corn-soybean meal diet during gestation. Producers also can benefit from high lysine corn in lactation diets although a higher level of dietary protein is necessary than in the gestation diet.

Young pigs need much more protein and amino acids than older swine. Pigs weighing 12-40 pounds require about 1 percent lysine in the diet compared with only about 0.5 percent for finishing pigs (125 pounds to market). Even so, the nutritional superiority of high lysine corn over normal corn has been shown in starter diets for young pigs.

Unquestionably, high lysine corn is nutritionally superior to normal corn for swine feeding because of its increased lysine content. When

high lysine corn contains at least 0.4 percent lysine, a diet approximately 2 percent lower in protein will support performance equal to a normal corn diet balanced at presently recommended protein levels. However, there is little or no benefit from high lysine corn in swine diets that contain these same recommended levels of protein.

FREE CHOICE FEEDING: Producers have the alternative of feeding the high lysine corn and protein-mineral-vitamin supplement free-choice—a common practice a few years ago. Numerous studies show that growing pigs will balance their diets for corn and protein with no loss in rate of gain or increase in feed/gain ratio. In similar tests where high lysine corn and normal corn (near equal protein content) were fed free-choice with a complete protein supplement, the pigs voluntarily reduced their supplement intake to compensate for the extra lysine content in the high lysine corn. The pigs receiving the high lysine corn ate almost 0.4 pounds less supplement and 0.2 pounds more corn per day than the pigs receiving normal corn. High lysine corn is softer in texture than some hybrid corns and can be fed shelled instead of ground in a free-choice feeding program.

The composition of corn-soybean meal diets based on regular corn and high lysine corn with varying lysine levels is shown in table 2. The percent lysine under the heading "High Lysine Corn" ranges from 0.34 to 0.46. Producers should have the lysine content of their corn determined and then follow the appropriate diet composition.

Table 2. Composition of Swine Corn-Soybean Meal Rations Using Regular Corn and High Lysine Corn with Varying Levels of Lysine

		Regular Corn	High Lysine Corn				
			Percent Lysine				
Ration	Ingredient	0.25	0.34	0.37	0.40	0.43	0.46
STARTER[a] (25-50 lb.)	Regular Corn	71.2					
	High Lysine Corn		73.9	74.6	75.4	75.4	75.4
	Soybean meal (49%)[b]	25.4	22.5	21.7	21.0	21.0	21.0
	Dicalcium Phosphate	1.4	1.4	1.5	1.5	1.5	1.5
	Limestone	1.2	1.4	1.4	1.3	1.3	1.3
	Salt	0.3	0.3	0.3	0.3	0.3	0.3
	Vitamin-Tr. Mineral Pmx.[c]	0.5	0.5	0.5	0.5	0.5	0.5
	Minimum requirements (percent of ration): lysine 0.95, calcium 0.8, phosphorus 0.6.						
GROWER[a] (50-125 lb.)	Regular Corn	81.5					
	High Lysine Corn		84.0	85.0	85.9	86.6	86.6
	Soybean meal (49%)[b]	16.0	13.4	12.4	11.5	10.9	10.9
	Dicalcium phosphate	1.0	1.1	1.1	1.1	1.1	1.1
	Limestone	0.9	0.9	0.9	0.9	0.8	0.8
	Salt	0.3	0.3	0.3	0.3	0.3	0.3
	Vitamin-Tr. Mineral Pmx.[c]	0.3	0.3	0.3	0.3	0.3	0.3
	Minimum requirements (percent of ration): lysine 0.7, calcium 0.65, phosphorus 0.5.						
FINISHER (125-220 lb.)	Regular Corn	86.6					
	High Lysine Corn		89.5	90.5	91.4	92.4	93.4
	Soybean meal (49%)[b]	10.7	7.9	6.9	5.9	4.9	3.9
	Dicalcium phosphate	1.2	1.2	1.2	1.3	1.3	1.3
	Limestone	0.9	0.8	0.8	0.8	0.8	0.8
	Salt	0.3	0.3	0.3	0.3	0.3	0.3
	Vitamin-Tr. Mineral Pmx.[c]	0.3	0.3	0.3	0.3	0.3	0.3
	Minimum requirements (percent of ration): lysine 0.55, calcium 0.5, phosphorus 0.5.						
GESTATION	Regular Corn	87.4					
	High Lysine Corn		90.2	91.2	92.2	93.2	94.2
	Soybean meal (49%)[b]	9.1	6.2	5.2	4.2	3.2	2.1
	Dicalcium phosphate	1.2	1.3	1.3	1.3	1.3	1.4
	Limestone	1.5	1.5	1.5	1.5	1.5	1.5
	Salt	0.3	0.3	0.3	0.3	0.3	0.3
	Vitamin-Tr. Mineral Pmx.[c]	0.5	0.5	0.5	0.5	0.5	0.5
	Minimum requirements (percent of ration): lysine 0.5, calcium 0.75, phosphorus 0.5.						
LACTATION	Regular Corn	80.5					
	High Lysine Corn		83.1	84.0	85.0	85.8	86.8
	Soybean meal (49%)[b]	16.1	13.5	12.6	11.6	10.7	9.7
	Dicalcium phosphate	1.0	1.1	1.1	1.1	1.2	1.2
	Limestone	1.6	1.5	1.5	1.5	1.5	1.5
	Salt	0.3	0.3	0.3	0.3	0.3	0.3
	Vitamin-Tr. Mineral Pmx.[c]	0.5	0.5	0.5	0.5	0.5	0.5
	Minimum requirements (percent of ration): lysine 0.7, calcium 0.75, phosphorus 0.5.						

[a]The composition of the starter and grower diets did not change at the higher corn lysine levels as lysine in the corn increased because methionine + cystine may be the first limiting amino acid rather than lysine.

[b]If soybean meal (44 percent) is fed instead of the (49 percent) soybean meal, increase the amount shown for soybean meal (49 percent) by about 12 percent and then reduce the corn by that same amount.

[c]Each pound of the vitamin-trace mineral premix contains 400,000 I.U. vitamin A, 40,000 I.U. vitamin D, 2,000 I.U. vitamin E, 300 mg. vitamin k, 400 mg. riboflavin, 1600 mg. pantothenic acid, 2400 mg. niacin, 2 mg. vitamin B_{12} plus the trace minerals. The trace minerals can be purchased separately from the vitamins and should supply the following in the complete diet (ppm): zinc, 100; iron, 50; manganese, 27; copper, 5.5; iodine, 0.75; cobalt, 0.5.

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